

SECTION 8

8.20 CONCRETE STRUCTURES:

- A. Formwork: Forms shall produce shapes, lines and dimensions of the concrete structures as shown on the Drawings.

The formwork shall be designed according to the loads and allowable stresses set forth in ACI 347.

Forms may be made of wood, metal or other acceptable material approved by Denver Water. The forms shall produce a smooth concrete finish to the tolerances described in ACI 301. Form material with raised grain, torn surfaces, worn edges, patches, dents or other defects, which will impair the texture of the concrete surface, shall not be used.

Forms shall be mortar tight and braced or tied to maintain its proper position and shape during and after concrete placement. Embedded metal ties with snap-off ends shall be used for internal form ties. Use of ordinary wire ties will not be allowed. Withdrawal of form ties through the walls will not be permitted.

All exposed edges shall be chamfered with a 3/4 inch, 45 degree bevel.

All surfaces of forms and embedded items shall be cleaned of all foreign material before concrete is placed. The recommendations of ACI 347 for form removal times under normal conditions shall be followed. Denver Water shall determine if additional time is required before form removal.

Forms shall be removed in a manner, which will insure the integrity of the structure and its surfaces.

- B. Mixing and Placing:

.. All equipment used in mixing and transporting concrete shall be clean. All debris, water or ice shall be removed from the places to be occupied by the concrete. Concrete shall not be placed on frozen subgrade. Wooden forms shall be thoroughly wetted (except in freezing weather) or a form release agent shall be applied.

Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C 94. Water may be added one time immediately upon arrival at the job site to bring the slump within the required limits.

The concrete shall be conveyed from the mixer to the place of final deposit by methods, which will prevent separation. Equipment for chuting, pumping and conveying concrete shall be of such size and design as to ensure a continuous flow of concrete at the discharge end without separation of materials. Concrete shall not free fall a vertical distance greater than five feet during discharge into the forms.

Concrete shall be deposited as nearly as possible in its final position to avoid segregation due to handling or flowing. Concrete shall be placed at a rate

such that it is, at all times, plastic and flows readily between reinforcing steel. Concrete that has partially hardened or is contaminated by foreign materials shall not be allowed.

Concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on or against concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the area or section. Concrete shall not be placed in lifts exceeding 18 inches in thickness.

The accumulation of water on the surface of the concrete due to water gain, segregation or other causes during placement and consolidation shall be prevented by adjustments in the mix design.

When placing concrete during cold weather as defined in ACI 306, the temperature of the concrete mix during placing shall not be lower than 55°F and all concrete work shall follow the recommended practices of ACI 306. When placing concrete during hot weather as defined in ACI 305, the temperature of the concrete mix during placing shall not be higher than 85°F and all concrete work shall follow the recommended practices of ACI 305. Cooling or warming plastic concrete mixtures shall not be undertaken without the approval of Denver Water.

C. Consolidation:

All concrete immediately after depositing shall be thoroughly consolidated with internal vibrators as recommended in ACI 309. Denver Water shall approve the size, type and number of vibrators used for each concrete placement. The concrete shall be thoroughly worked around the reinforcing steel, around embedded items and into the corners of the forms. Vibrators shall be supplemented by spading, rodding or forking to eliminate all honeycomb at the form face and voids around embedded items.

D. Finishing:

Where concrete surface finishes are not shown on the Drawings, unformed flat surfaces shall be screeded and wood float finished and interior floor surfaces shall be steel trowel with light broom finished to Class A tolerance in accordance with ACI 301.

No wetting of concrete surfaces during slab finishing operations shall be permitted. No concrete finishing operation shall be performed while there is water on the surface.

E. Construction and Contraction Control Joints:

Construction joints not indicated on the Drawings must have specific approval of Denver Water. All concrete surfaces where joints are made shall be thoroughly cleaned and laitance removed prior to placing adjoining concrete. Contraction control joints shall be cut one quarter the depth of the slab. When power saw cutting methods are used, joints shall be cut as soon as the concrete surface is firm enough not to be torn or damaged by the saw blade.

Water employed in cutting, washing and rinsing of concrete contraction control joints shall not stain, discolor or affect exposed surfaces of the structures, or damage the environment of the project or adjacent areas. Methods of waste water disposal shall be subject to approval by Denver Water.

F. Curing and Protection:

All concrete shall be cured by a method recommended by ACI 308. When the daily mean ambient temperature is above 40°F, the finished concrete shall be cured continuously for a minimum of 7 days or for the time necessary to attain 70% of the specified compressive strength, whichever period is less. When the mean daily ambient temperature is 40°F or lower, the finished concrete shall be continually cured at a minimum temperature of 55°F for the period recommended by ACI 306 to prevent damage from early-age freezing and provide the service category strengths required for each placement.

Concrete curing on formed surfaces shall be initiated immediately after removal of the forms or as directed by Denver Water.

Concrete curing on slabs shall be initiated immediately after the water on the surface of the slab has evaporated or as directed by Denver Water.

G. Surface Repair:

Surface defects, including fins, tie holes, and honeycombed areas shall be repaired down to solid concrete accordance with ACI 301.